

UNCLASSIFIED

AD 433874

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA, VIRGINIA



UNCLASSIFIED

Best Available Copy

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

64-11

433874

CATALOGED BY DDC
AS PL 140.

433874

Report on
INDIVIDUAL CLOTHING AND EQUIPMENT
for
INDIGENOUS FORCES IN SOUTHEAST ASIA

Phase I
Covering the Period
June 1 to November 29, 1963

Sponsored by:

Advanced Research Projects Agency
Washington, D. C.
ARPA Order No. 267, Amendment 6



U. S. ARMY NATICK LABORATORIES
NATICK, MASSACHUSETTS

1964

REPORT ON
INDIVIDUAL CLOTHING AND EQUIPMENT
FOR
INDIGENOUS FORCES IN SOUTHEAST ASIA

Phase I
Covering the Period
June 1 to November 29, 1963

Sponsored by
ARPA Order No. 267, Amendment 6
Program Code No. 3860
May 8, 1963

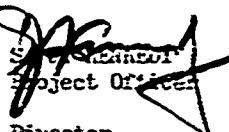
U. S. Army Natick Laboratories
Natick, Massachusetts

SYNOPSIS

This report covers the work done by the U. S. Army Natick Laboratories, Natick, Massachusetts, under ARPA Order No. 267, Amendment 6 on "Individual Clothing and Equipment for Indigenous Forces in Southeast Asia". It summarizes the work done by Dr. Robert White in conducting anthropometric studies of military personnel in Thailand and the Republic of Viet Nam, the work of Dr. S. J. Kennedy and Mr. Eldon Metzger on a survey of the individual clothing and equipment of the Royal Thai Army and the Army of the Republic of Viet Nam, and the human factors studies conducted by Major J. W. Chaffin and Mr. E. W. Youngling.

Upon the completion of the survey of clothing and equipment items in each country, Dr. Kennedy and Mr. Metzger submitted a report to the ARPA R&D Field Unit and the CDTC in each country. A total of 31 recommendations were submitted on the clothing and equipment of the Royal Thai Army, and 33 on the corresponding equipment of the Army of the Republic of Viet Nam. It is understood that action has been taken in each country to implement some of these recommendations; also certain items have been sent over for test in accordance with request of the respective ARPA Field Units, together with test plans for the conduct of the tests. Certain other equipment has been requested but has not been supplied up to this time due to lack of funding of the balance of the program up to this point.

Copies of the recommendations submitted by Dr. Kennedy and Mr. Metzger to the ARPA R&D Field Units in Thailand and Viet Nam at the conclusion of Dr. Kennedy's visit to Viet Nam are inclosed as attachments.


S. J. Kennedy
Project Officer

Director
Clothing & Organic Materials Division
U. S. Army Natick Laboratories
Natick, Massachusetts

ARPA Order No. 267, Amendment 6

U. S. ARMY NATICK LABORATORIES
Natick, Massachusetts

INDIVIDUAL CLOTHING AND EQUIPMENT FOR INDIGENOUS
FORCES IN SOUTHEAST ASIA

1. PURPOSE

The purpose of the Phase I study has been to obtain and evaluate information which can be used to design and develop improved individual clothing and equipment for indigenous forces engaged in or threatened by conflict in Southeast Asia. One aspect of the study has involved human factors studies, particularly the taking of anthropometric measurements of military forces in those areas, as a basis for establishing appropriate design parameters for their clothing and equipment.

2. SCOPE

As outlined in the referenced directive of May 8, 1963, and in Program Plan No. 103, dated April 18, 1963, Phase I of the study was intended primarily to obtain information on the problem. It was considered to embrace the following essential tasks:

- a. To examine items and types of individual clothing and equipment to be studied.
- b. To develop prototypes of improved items with initial emphasis on load carrying equipment.
- c. To study the availability in Thailand and Viet Nam of materials required for the manufacture of individual clothing and equipment.
- d. To study the capability of production facilities in those two countries to manufacture items of individual clothing and equipment.
- e. To study human factors peculiar to the military personnel in the armies of those two countries which need to be considered in designing items of individual clothing and equipment for them.

It was recognized, however, that in this first phase, some work would of necessity be started which would extend into the subsequent phases of the study, particularly testing and evaluation. Also because of the stress laid upon obtaining a "data base" before initiating major developments, the latter have not been undertaken, pending approval from ARPA of the recommendations in the Phase I effort.

3. ACTIONS TAKEN

Anthropometric Surveys

An anthropometric survey of a sample of the Armed Forces of the Kingdom of Thailand was conducted between October 1962 and March 1963. A total of 2,950 men was measured; of this total, 68 percent were Royal Thai Army personnel; 21 percent were Royal Thai Marine Corps personnel, and 11 percent were Royal Thai Air Force personnel. Fifty-two body measurements were made on each man. The anthropometric data resulting from this survey are now undergoing analyses. Upon completion of these analyses a final report on the anthropometric survey of Thailand will be published.

An anthropometric survey of a sample of the Armed Forces of the Republic of Viet Nam was carried out during the month of June 1963. A total of 2,130 men was measured. Of the total, 58 percent were Army personnel, including samples from two Infantry Divisions, as well as Airborne personnel and basic trainees. Approximately 14 percent of the total sample were Navy personnel, 14 percent were Marine Corps personnel, and 14 percent were Air Force personnel. Fifty-one body measurements were taken on each man. The anthropometric data from the survey of the Republic of Viet Nam have been transferred to punch cards and are now undergoing data processing in preparation for final analyses. Upon completion of these analyses a final report on the survey of the Republic of Viet Nam will be published.

Survey of Items of Individual Clothing and Equipment

This study was conducted by Dr. S. J. Kennedy, Director, Clothing and Organic Materials Division, U. S. Army Natick Laboratories, and Mr. Eldon C. Metzger, Equipment Specialist, U. S. Army Natick Laboratories, in Thailand and Viet Nam during the period 15 to July 15, 1963. Mr. Metzger then stayed on until September 15 to complete his design studies on load carrying equipment and to develop prototype items for evaluation.

With the assistance and cooperation of the CMIC and ARPA E&D Field Unit in each country, Dr. Kennedy and Mr. Metzger completed a survey of the items being used by the troops, of the availability of critical materials required for their production, and of production facilities.

It was apparent that certain actions could be taken at once to improve the items in use, to reduce the weight of the soldier's load, and, based upon U. S. experience, particularly in the furnishing of equipment to U. S. Special Forces, to provide certain other items which would increase the effectiveness of their troops in the field.

Because of the shorter height and smaller frame of Thai and Vietnamese soldiers, as shown in the preliminary data reported by Dr. White, the problem of reduction in weight of the soldier's load is even more critical in the case of these troops than for U. S. troops.

The anthropometric studies conducted by Dr. White have shown that the height of the average Vietnamese soldier (50th percentile) is only 5 ft. 2-1/2 inches, and 5 ft. 4-1/2 inches for Thais, as compared with 5 ft. 8-1/2 inches for the U. S. soldier; also that the average Vietnamese weighs only 108 pounds, and the Thai only 120 pounds, as compared with 152-1/2 pounds for the U. S. soldier.

Using the rule-of-thumb that the soldier's load should not exceed one-third of his body weight, it will be evident that whereas a load of 50 pounds could be adopted for U. S. loads, it should be reduced to not over 35 pounds for Viet Nam and Thai soldiers. Hence, if lightening the load of the U. S. soldier is a top priority, as directed by the Commanding General of CDC, it is even more important for these peoples of Southeast Asia, whom we are assisting in their fight against Communism.

It would thus appear that the rule that should be followed in providing clothing and equipment to these troops would be that every item of personal equipment should be one-third lighter in weight than that provided to the U. S. soldier.

Also, the type of operation which appears to be characteristic of fighting in Viet Nam by all of the Army elements, apparently envisages longer sustained operations without resupply than present U. S. load carrying equipment was designed for. The characteristic operation exceeds one full day, and for many operations, a three-day operation without resupply may be expected.

Accordingly, the existing U. S. load carrying equipment either 1945 or 1956, particularly the pack which was designed to carry no more than one half day's supplies, is too small in carrying capacity to contain the required equipment which the soldier must carry.

We thus have the problem of a smaller man, needing equipment that in total weighs a third less than corresponding U. S. equipment, but who must be prepared to mount an operation in which he may have to carry substantially more supplies than we had planned for U. S. troops to carry.

The need for lightening the weight of everything the Viet Nam soldier carries is therefore doubly important.

It is recognized that these people are hardy and tough, and are accustomed to great physical exertion. There are physiological limits, however, to the capabilities of all peoples, and it would be wrong to presume that because of this, they should be required to carry needlessly heavy loads.

At the request of the CDTG unit in each country, a report containing a series of recommendations was prepared before departure of the team from each country and was submitted to the Director of the CDTG for approval. These reports are attached herewith. They have already been submitted to ARPA Headquarters by U. S. Army Natick Laboratories in the Report of Travel of Dr. Kennedy and Mr. Metzger, dated 24 July 1963.

These two reports contained the following recommendations:

THAILAND

Footwear	-	11 recommendations
Load Carrying Equipment	-	1 recommendation
Sleeping Gear & Rain Gear	-	5 recommendations
Clothing	-	9 recommendations
Handwear	-	1 recommendation
Other Equipment	-	4 recommendations
Total -		31 recommendations

VIEt NAM

*Footwear	-	6 recommendations
Load Carrying Equipment	-	4 recommendations
Sleeping Gear & Rain	-	7 recommendations
Clothing	-	10 recommendations
Other Equipment	-	6 recommendations
Total -		33 recommendations

*The recommendations on the jungle boot suggested seven specific actions.

Development of Prototypes, Particularly of Load Carrying Equipment

Since a major aspect of the program was concerned with load carrying equipment, Mr. Metzger, the U. S. Army Natick Laboratories equipment designer in this area, devoted a major part of his time to work on developing a load carrying system out of materials that could be produced locally in each country.

As a base for the load carrying development, the item recently adopted by the U. S. Army Special Forces, was used as a model. (For details, see discussion in the report submitted to CDIC-1 under date of 1 July - attachment 1 to referenced Report of Travel).

Mr. Metzger completed the production of 12 of these pack systems, with the canvas and webbing stitching done in the shops of the Thai Army Clothing and Shoe Factory, and the rattan frames made by a local furniture maker. The required brass hardware was also made by a local shop. The webbing and canvas used were such as could be made in the Bangkok mill of the Thailand Textile Organization.

Ten of these packs were furnished to the Thai Ranger Battalion, Lopburi, for evaluation on the Northeast frontier, and one to the ARPA R&D Field Unit, Viet Nam for illustration. Further development is awaiting report of test from the Thai Ranger Battalion.

Development and/or test of other proposed items has been either already initiated or is awaiting approval of actions recommended in Thailand and Viet Nam.

For example, 500 lightweight multi-purpose nets have been furnished to Viet Nam for testing by the Ranger Forces; 3,000 yards of lightweight camouflage fabric for combat uniforms have been produced and shipped to Viet Nam for making into uniforms for Ranger Forces.

Also the RIA Quartermaster has appointed a committee to consider the recommendations submitted in that country, and action has already been taken on some and modified items are undergoing test.

Survey of Materials, Availability and Production Facilities

THAILAND

In Thailand it was apparent that their industrial base for producing the basic textiles for their uniform was adequate, though in need of modernization. The durability of their uniform fabric is, however, compromised by the necessity of their using native Thai cotton (averaging 5/8" staple) in its manufacture.

Their government cotton mill was also found to be capable of manufacturing narrow fabrics (webbings) and lightweight duck; also it is able to finish their fabrics with required functional finishes. Their technical staff was

quite adequate to produce any required fabrics, and to improve their existing fabrics if better cotton could become available, or the plant could be re-equipped with modern equipment (we were advised of a new textile mill then being built).

Also in the civilian economy there are facilities for producing continuous filament fabrics should the RIA decide to adopt nylon fabrics for some uses and be able to import or produce the nylon yarn. Such fabrics are not deemed essential to the military, but would help reduce the load on the soldier at such time as the Royal Thai Army decides to make such a move.

In garment fabrication and boot production, for the RIA, the existing plants are adequate but could be improved by the use of more modern equipment, in the interest of greater efficiency, and in attaining better quality control. Capability was not found to be available for stitching heavy webbing for load carrying equipment. However, three additional sewing machines were obtained on a pilot basis to demonstrate how this webbing equipment should be made and for the production of test samples. There should be no difficulty in extending this capability to any required volume.

In general, it is apparent that responsibility for improvement in manufacturing capabilities lies within the scope of other U. S. government assisting agencies.

It is not felt, accordingly, that any major action is required under the project in this area other than insuring that production facilities are available. As to upgrading the quality of their textile materials, this also falls under the scope of work being done by other agencies because of their close relationship with the civilian economy for which other forms of assistance are being provided.

Viet Nam

Essentially the same situation applies here in respect to availability of materials and production facilities as in Thailand, except that U. S. government assistance in this area has been broader and involves the use of U. S. types of cotton. Three large modern cotton textile mills are now available in the Saigon area and also mills for the production of filament nylon fabrics for women's apparel and plants available for the making of nylon fish-nets. It is considered that the facilities of these plants are adequate from the standpoint of production capability of making woven fabrics required by the Viet Nam Army, other than heavy ducks. Information was not obtained as to the availability of knitting facilities or narrow fabrics mills.

Human Factors Recommendations

The Engineering Psychology Laboratory, Pioneering Research Division conducted a human factors study of problems and considerations associated with use of equipment and clothing by indigenous ground forces of the Royal Thai Army and the Army of the Republic of Viet Nam. Based upon field observations

of Infantry, Airborne, Rangers, Marine, Strike Force and Commando units, four major problem areas were isolated; namely, problems of choice of equipment, problems related to combat jungle environment, problems associated with specific cultural factors, and problems associated with sizing, configuration and compatibility of equipment items. Human factors recommendations concerning each equipment item were published in a report entitled, "Human Factors Evaluation of Clothing and Personal Equipment in Thailand and the Republic of Viet Nam," by J. M. Chaffin, Major, QMC, and E. W. Youngling, Research Psychologist, U. S. Army Natick Laboratories, Natick, Massachusetts, August 1963.

Recommended Action on Further Phases of the Study

In view of the fact that the many different items included in the study will be in different phases of development and testing and/or evaluation at any given time, it is recommended that Phase II and III be combined with any further prototype development required under Phase I, and that the project be continued to completion as a single Phase.

Further work deemed to be desirable to carry this program to completion would involve implementation of the recommendations contained in the two reports submitted in Thailand and Viet Nam, with any modifications found necessary as the work progresses. A listing of these tasks and the funds considered to be required is given in the attached table of estimated required funding. This proposed funding includes costs to the U. S. Army Natick Laboratories, costs of prototype development, costs of items for test and other work needed for completion.

Statement of Funds Expended to Date:

	<u>Amount Accepted</u>	<u>Committed as of 11/26/63</u>	<u>Obligated 11/26/63</u>	<u>Uncommitted Balance</u>
Human Factors	\$30,000.00	\$27,704.45	\$23,784.14	\$2,295.55
All Other Tasks	\$50,000.00	\$4,404.66	\$34,635.94	\$5,595.34

Funds required for the various uncompleted tasks and for general technical assistance to the ARPA R&D Field Units and the Armies in the two countries are listed on the detailed statements of funding attached hereto. Total funds required for completion of the work are as follows:

	<u>FY/64</u>	<u>FY/65</u>
Viet Nam	\$166,000.00	\$51,200.00
Thailand	67,556.00	-----
Total	\$253,556.00	\$51,200.00

Work on the uncompleted tasks can be resumed immediately upon receipt
of required funds.

b Incl

1. Rpt to Director, CDTC-T
2. Rpt to Director, CDTC-V
3. Statement of Funding
for Thailand
4. Statement of Funding
for Viet Nam



S. J. KENNEDY
Project Officer

Director
Clothing & Organic Materials Division
U. S. Army Natick Laboratories
Natick, Massachusetts

APPROVED:



Dale H. Siefing
DALE H. SIEFING
Scientific Director



Merrill L. Tribe
MERRILL L. TRIBE, Brigadier General, USA
Commanding

ATTACHMENT 1

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH AND DEVELOPMENT FIELD UNIT
APO 146

SAN FRANCISCO, CALIFORNIA

1 July 1963

SUBJECT: Report on Preliminary Evaluation of the Individual Clothing
and Equipment of the Royal Thai Army

TO Director, CDTC-T

Purpose:

The purpose of the study has been to obtain and evaluate information which can be used to design and develop improved individual clothing and equipment for the Royal Thai Army.

The tropical climate and the physical environment of Thailand place severe requirements upon individual combat clothing and equipment. Also, the tropics place severe physiological stress upon the troops. Accordingly, clothing and equipment for use in such areas should be as light in weight as possible, and should otherwise be so designed and proportioned on the soldier as to minimize physiological stress.

Since Thais of military age are shorter (about four inches) and lighter in weight (about thirty pounds) than U. S. Army troops, and appear to have ethnic differences in foot shape and sizes, it cannot be assumed that equipment developed for U. S. troops will necessarily serve the needs of the RTA. Actually, equipment of light weight would be desirable, and sizes of certain items will need to be smaller, both in the interest of uniform fit and avoidance of carrying useless weight.

The requirements of the RTA appear to conform most nearly to those of the U. S. Army Special Forces for similar climate and terrain. Accordingly, in evaluating RTA needs, special consideration has been given to QM R&E Center experience in developing individual clothing and equipment to meet the need of U. S. Army Special Forces.

In conducting this study three principal guide lines have been followed:

a. Design and Material Needs.

Attempts have been made to determine the actual needs, i.e., the essential military requirement which the item must meet. Consideration has been given to the possibility of supplying the item from locally available materials or at least to fabricate it locally if some or all of the materials must be imported.

b. Quality Control Capabilities.

In the production of the item there must be assurance that manufacturing processes will be so controlled that the items delivered to troops will perform uniformly well. The essential requirements here are for adequate specifications and inspection during manufacturing.

Attachment 1 (Continued)

c. Proper Fit and Use.

The items must properly fit the soldier for whom they have been designed. For example, the shoe must have the proper shape and internal space so that it is comfortable on the foot. Also, it must be issued in the correct size so that it fits properly - otherwise foot injury will occur. Items must also be used as the designer intended they should be used. To accomplish this provision must be made for proper instructions on the use of items, and training in their correct issue and use.

Suggested Phasing of Individual Clothing and Equipment Project:

1. First Phase. Initial visit of Kennedy Party to Thailand - June 1963.

a. Determine items and types of individual clothing and equipment to be studied.

b. Study the availability in Thailand of raw materials used in the manufacture of individual clothing and equipment.

c. Study the capability of Thailand to manufacture items of individual clothing and equipment.

d. Study human factors peculiar to Thailand which should be considered when designing items of individual clothing and equipment for Thai Armed Forces personnel.

2. Second Phase.

Selected test items of individual clothing and equipment will be fabricated in the U. S. (and/or Thailand) and shipped to Thailand.

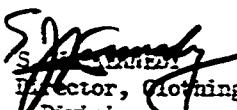
3. Third Phase.

Field evaluation - Items of clothing and equipment will be evaluated by selected Thai Armed Forces Unit(s). Evaluation will include controlled tests as well as operational evaluations. Some items will undoubtedly have to be modified and redesigned during the course of the evaluations. It is hoped arrangements can be made whereby the modification can be performed in Thailand, rather than the U. S.

4. Fourth Phase.

Preparation of final report. Recommendations to Chief of Staff, Supreme Command Headquarters concerning ways and means to improve items of Individual Clothing and Equipment for the Royal Thai Armed Forces.

1 Incl
Comments


S. J. Kennedy
Director, Clothing and Organic Materials
Division
QW P&E Center, Natick, Massachusetts

INCLOSURE 1

TO

ATTACHMENT 1

FOOTGEAR

Boots are perhaps the most important item of equipment furnished to the soldier. For this reason their proper design and construction, and proper fitting at the time of issue are of great importance.

Our survey has shown a number of actions that can be taken at once to improve the boots being supplied to the Thai Army; also some actions that should be taken as soon as practicable; and one longer range study that should be initiated.

For Immediate Action:

Recommendation 1

The present height of the RIA boot should be reduced in height by an average of two inches, to a 9" height (average).

This action should be taken on boots being manufactured as soon as clicker dies can be obtained. Troops should also be authorized to take their boots to repair shops or to local shoemakers to have them cut down, eliminating the top two eyelets on the front stay. When this is done, the leather top facing should be restitched around the inside of the new top of the boot.

There are two reasons for this recommended action. The anthropometric measurements made by Dr. Robert White have shown that the knee height of Royal Thai Forces is on the average $1\frac{1}{2}$ - 2" less than for U.S. Forces. Accordingly, Thai troops should have a boot that actually is shorter than that worn by U. S. troops.

Also, the U. S. after careful testing, has recently reduced the height of its boot by $1\frac{1}{2}$ inches, from 11 inches to $9\frac{1}{2}$ inches (Middle size). There have been two reasons for this action. One is that the U. S. forces no longer require to turn their trousers into their boot tops. This change was made partly to overcome discomfort and partly to keep rain water from draining off the leg into the boot. Also it makes it easier to keep the sock up and to keep leeches out. The trouser bottom is now tied over the top of the boot, with a cord inserted in the bottom hem of the trouser leg.

The other reason for reducing the height of the boot is to avoid constricting the calf muscle, the big muscle of the leg. The new height holds the boot below this muscle.

In view of the above, a two inch reduction in the height of the RIA boot which is the same height as the previous U. S. boot is considered desirable.

Inclosure 1 to
Attachment 1 (Continued)

Recommendation 2

Provision should be made for a draw cord or tape in the bottom of the trouser hem.

Two button-holes are needed on the inside of the hem at the side seam. The draw cord or tape should be bar-tacked at the inside seam to prevent its pulling out. If properly done it will not affect the appearance of the trousers when they are worn as dress trousers.

This action should be taken at once, on new production, and men should be authorized to have local repair facilities or tailors make this change on their present trousers.

Also authorization should be made for this change in method of wearing the trousers outside the boots.

Cost Factor: Some net saving should result from the reduction in height of the boot through the saving in leather. This should compensate for the slight added cost in the trousers.

Recommendation 3

The proper fitting of shoes at time of issue should be made a command responsibility. Company commanders should be held responsible for seeing that their men receive boots that fit properly; also that any foot injury is promptly and effectively treated.

In support of such action, a full range of sizes should always be available at the issue point, so that substitutions can be avoided.

Actions to be Taken As Soon As Practicable

Recommendation 4

The present socks should by all means be replaced with a heavier sock at the earliest date.

The present socks do not give enough protection to the feet; also they work down easily into the boot, bunch up and will cause foot injury through blisters and callouses.

As to a proper sock this would depend upon the capabilities of your Thai knitting industry. A part-wool heavy sock is the best type. It would not, however, have to have a cushion sole like the U. S. sock. If it contains wool, the wool must be shrink-resistant treated. There are good all-cotton cushion sole socks available which might prove adequate.

It is suggested that a determination be made as to where such a sock might be obtained. Suggestions can then be made as to proper construction and specifications.

Inclosure 1 to
Attachment 1 (Continued)

Cost Factor: A good sock will cost more than your present socks. It will reduce the need for medical attention, however, and will definitely increase the combat and marching capability of troops. It is not wise to try to save money on socks.

Recommendation 5

A traction or "lug" sole should be adopted for the sole of the boot.

In tropical areas where mud prevails during part of the year, a traction sole is to be preferred. A sole of this type has been applied to some boots by the shoe factory located at the Thai Tanning Organization, using Goodyear Welt stitching. It is suggested that the sole you have already used be adopted for the present. The exact pattern of the tread is not critical, and this pattern appears to be entirely adequate.

Cost Factor: A traction sole will cost slightly more than a flat sole at first, but should ultimately cost the same, on an equal poundage of rubber basis.

Recommendation 6

The present thread used in RIA leather boots should be replaced with either mildew-treated linen or cotton thread, or with synthetic fiber threads. We recommend synthetic fiber thread.

Shoe thread which has not been mildew-proofed will deteriorate rapidly in a warm humid climate. While linen and cotton thread can be mildew-proofed, U.S. experience has been that to get uniform treatment is very difficult, and has been a source of continual controversy with suppliers. Synthetic threads such as to the U. S. now uses in its boots, are not attacked by micro-organisms. Boots made from them will last longer if properly stitched. (Detailed recommendations on sewing threads for boots will be submitted separately).

Cost Factor: Synthetic threads should not raise the cost of boots more than five cents per pair (U.S.).

Recommendation 7

That all leather components in combat boots be given a mildew-proofing treatment during the tanning process.

Leather and the oils and fillers used in making it, are subject to attack by many micro-organisms. This may lead to rotting of the footwear when new on the shelves in warm humid climates, or in the field.

It is recommended specifically that paronitrophenol be used for this purpose. The U. S. has treated all of its leather for combat footwear for mildew protection for many years.

Inclosure 1 to
attachment 1 (Continued)

Recommendation 8

Brass drainage eyelets should be inserted in each boot as on U.S. Tropical Combat Boots, to permit drainage of water when the wearer goes into water over his boot tops.

Recommended specifications for these eyelets are available.

Cost Factor: Small increase; slightly more than the cost of the two lacing eyelets that are being eliminated.

Recommendation 9

Consideration should be given to the requirement for protection in the boots against spikes and similar devices for penetrating the foot.

These spikes and sharpened bamboo stakes have been extensively used by the Viet Cong in Viet Nam. They are an effective psychological weapon to people whose shoes do not provide protection against them, as well as a real incapacitating weapon that may be lethal due to blood poisoning.

The U. S. has provided such protection in boots furnished to the Viet Nam Army, in the form of steel plates vulcanized into the rubber sole of their canvas-top boots. Such protection is also being provided to U. S. Army Special Forces, at present in the form of slip soles.

Testing of the U. S. Army combat boot has demonstrated that it will not by itself provide protection against these spikes under all conditions, even with the leather mid-sole.

For this reason we recommend that consideration be given to providing such protection in RIA boots. We have found two ways to do it — (a) An emergency method of using slip soles inside the shoes. There may not be room enough in some boots for this, unless larger sizes are provided. This method provides the protection when it is known to be needed; (b) Incorporate the steel plates into the insole, by using a double insole. Where Goodyear Welt boots are being used, this appears to be the most practicable way of adding this protection into the boot.

Cost Factor: If this type of protection is considered to be needed, the small additional cost should not be a deterrent. The U. S. slip soles cost \$3.50.

Recommendation 10

Consideration should be given to using cloth for the upper of the boot in place of leather.

Inclosure 1
Attachment 1 (Continued)

U. S. experience is that a cloth top boot is more comfortable, cooler and dries out faster in a warm climate than leather. Also it is lighter in weight.

A mildew-proofed cotton duck will serve for this purpose, although at present the U. S. boot uses a nylon-cotton blend. (Detailed recommendations on fabric and patterns will be supplied, if desired).

Cost Factor: The cotton duck should be cheaper than leather.

Longer Range Actions

Recommendation II

A new last for footwear for the Royal Thai Armed Forces should be developed.

The lasts presently being used to produce footwear for the Thai Armed Forces are apparently not shaped to meet the needs of a considerable proportion of men of military age.

The anthropometric study made by Dr. Robert White has shown that Thai feet of the same length as those of U. S. troops are nearly two widths broader. Also there are apparent differences in instep height and foot shape that will make it difficult to fit Thai soldiers easily in boots made over lasts designed for European peoples.

A competent last designer should be engaged to develop a suitable last for use in making Thai military footgear.

This task would be a research project under ARPA and could probably be completed within a year after the person who is to do the work has been engaged.

LOAD CARRYING EQUIPMENT

The recently adopted (1956) U. S. load carrying equipment of the individual soldier is not suitable for the Thai soldier and should not be furnished to them. Its basic principle requires the placing of the equipment on the belt. This creates difficulties in the U. S. Army which have not been solved to date. However, with the waist girth of Thai soldiers averaging two to four inches smaller than that of U. S. soldiers, the equipment will not work properly. (The M-1944 equipment would serve better, if the front attachment straps were modified to fasten to the belt, instead of to the back).

Careful consideration of the problem of the Thai Army has led to our planning a load carrying system which will be simple and which, we believe, can be wholly made in Thailand.

Inclosure 1 to
Attachment 1 (Continued)

This system of load carrying is based upon developing three inter-related components, which may be used together, or in different combinations:

(1) A shoulder harness made of cotton webbing, with a belt, which will contain pockets for M-1 ammunition, and will have the capability of attaching to it, the canteen, the knife and the entrenching tool. These items could also be attached on the back, if desired.

(2) A pack bag which can be fastened to this harness above the waist in back, but which can also be carried separately. The exact capacity of this pack will need to be determined based upon a firm list of what items the man will carry into combat.

Above this pack bag on the back there will be room to attach the sleeping gear and any other items in the "marching load", as compared to the "combat load" -- it is U. S. doctrine that this group of items will be dropped somewhere in the rear, or left on vehicles when men go into actual combat.

(3) A lightweight frame, which may be attached to the harness, and to which the sleeping gear, and the pack bag may be attached. This frame will substantially increase his capability for carrying the "marching load", and will enable him with greater comfort to carry sufficient to keep him in the field for a longer period of time without resupply. It will be especially applicable to troops in counter-insurgency type operations. It will follow a design recently adopted by the U. S. Army Special Forces.

It will have the further capability of carrying logistic loads; such as ammunition cases, 5-gallon gasoline or water cans, bazooka rockets, radios, etc. It would replace the packboard for practically all carrying purposes, yet still be light enough to be part of the ordinary soldier's equipment, if desired.

While it is still too early to determine just how successful this approach will be, we have done the basic development work and it appears to be practicable. The webbings and duck would all be made in Thailand in the government cotton mill, and the frame would be made of rattan.

Mr. Metzger has come to Thailand prepared to work out a prototype. For this he will need the following:

(a) Access to heavy duty sewing equipment for stitching heavy webbings and for making experimental samples. He will need an experimental English speaking sewing machine operator to work with him part-time.

(b) The assistance of one or two company grade officers in handling the development and evaluation of these prototypes that are made. It would seem that evaluation by a Ranger officer would be desirable.

Inclosure 1 to
Attachment 1 (Continued)

(c) Assistance in obtaining brass hardware such as buckles and snaps and in the making of dies either here or in the U. S., so that the hardware items can be produced in Thailand.

(d) Assistance in preparing practical specifications for Thailand so that a test quantity can be produced.

Recommendation

That the proposed prototype be made and evaluated as planned, and if it appears promising that 100 sets be made for troop trials.

Cost Factors: If it is made in Thailand the cost should be substantially less than present load carrying equipment supplied from the U. S. An estimated cost can be supplied after a successful prototype has been made.

SLEEPING GEAR AND RAIN GEAR

The items used for sleeping and rain protection by the RTA at present are a poncho, a shelter half, a mosquito bar and a blanket. Their combined weight comprises the largest part of the soldier's load other than his weapon and ammunition. A serious effort should, accordingly, be made to reduce their weight.

Recommendation 1

The size of the poncho should be reduced.

The U. S. Army poncho is 92" x 66". However, the 50th percentile U. S. Army soldier is 68.5 inches tall whereas the average Thai soldier is 64.6 inches tall. A large poncho of the U.S. Army may also interfere with walking for a substantial part of Thai Army personnel.

Tentatively, it is recommended that the poncho be reduced to 82" x 60". Ponchos of this size should be made and tested. If found adequate in size for Thai soldiers over 66" tall, and not too large for soldiers 61" tall, this smaller size should be adopted.

Cost Factor: This change in size will eliminate one-fifth of the fabric in the poncho.

Recommendation 2

A lighter weight poncho fabric should be adopted, to reduce the total weight of the poncho.

Since it is understood the poncho is being obtained outside Thailand, it is presumed that advanced technology applicable to such a fabric will be acceptable. The development of an improved fabric will be undertaken, with the objective of holding the cost as near as possible to that of the present item.

Inclosure 1 to
Attachment 1 (Continued)

Cost Factor: Some increase in cost may result although how much cannot be estimated at this time.

Recommendation 3

A lighter weight blanket should be adopted.

The present blanket is bulky and heavy and when wet, would be very heavy indeed. Also it dries out slowly. However, a blanket of some kind would definitely be needed by troops at night in a large part of Thailand during part of the year. Provision of such an item is deemed to be essential.

From presently available information, it is not believed that a satisfactory blanket can be made in Thailand. It is suggested, accordingly, that a blanket like the present Standard, U. S. Army, Blanket, Lightweight be considered. It could be produced in Japan or Hong Kong or wherever woolen type fabrics are made.

The U. S. Army has developed experimentally a "poncho liner" made from a polyester batting sewn between two layers of lightweight nylon, parachute fabric. It would weigh only 1.25 pounds in the size recommended for the Thai poncho and dries out quickly.

It is suggested that as a first step toward adoption of a replacement for the present Thai Army blanket, the above two items be tested.

Cost Factor: Both items will cost more than the present Thai blanket.

Recommendation 4

That an item which can serve as a hammock be tested by Ranger Forces at an early date, and be considered for adoption by RTA.

It is U. S. jungle and special warfare doctrine that troops should have an item which can serve as a hammock, in order to provide restful sleep in areas where sleeping on the ground is not practicable.

It is specifically recommended that the Net, Multi-purpose be considered for adoption; initially by Ranger Forces and later, if found satisfactory by all troops. This item will serve the following purposes:

- (1) As a hammock.
- (2) For camouflaging a position or concealing a cache.
- (3) For carrying bulky or awkward-shaped boxes or items, for example, from a drop zone.
- (4) For covering a panji-pit.
- (5) As a seine for catching fish in a stream, and traps to catch animals.
- (6) As an emergency means of carrying loads on pack animals.
- (7) As an emergency litter.

Inclosure 1 to
Attachment 1 (Continued)

It is suggested this item be evaluated first by your Ranger forces, and later be tested on a larger scale by other troops.

Cost Factor: Cost of the Net, Multi-purpose in the U. S. has been around five dollars. It is anticipated that if bought in Japan the cost would be considerably less.

Recommendation 5

That a lightweight sweater be provided to all troops to provide extra warmth at night.

The U. S. Army has, since World War II, had a lightweight wool sweater as an auxiliary item to provide warmth while sleeping in tropical areas. Such an item is definitely needed. The U. S. item weighs only 12 ounces. A serviceable, tightly knitted sweater can be obtained readily at about this weight. If made of wool, it should be treated for shrink resistance.

Cost Factor: Will depend upon what item is selected.

Note on the Shelter Half

The shelter half, while a useful item for training and in peace time, has been found less desirable in actual combat, except as a ground sheet.

It is suggested that it not be considered a part of the individual soldier's load, but, if it is to be used, it be considered as organizational equipment. Its weight adds excessively to the soldier's load.

CLOTHING

In view of the fact that the present training uniform would be expected to be used in combat, the improvement of this uniform from the standpoint of durability and functional use should receive the most careful attention.

FABRIC

At the present time the cotton fabric for this uniform appears to be inferior to that used in the general wear or service uniform. This is undesirable.

Recommendation 1

That a new fabric be developed for the combat uniform utilizing some cotton other than 5/8" Thailand cotton, which will have a high degree of strength and abrasion resistance; and that when this fabric is developed it be immediately adopted for this uniform.

Cost Factor: Some additional cost, which will be practically compensated by increased service life, particularly in field use.

Inclosure 1 to
Attachment 1 (Continued)

CONSTRUCTION

Recommendation 2

Points of stress in trousers and shirt should be bar-tacked.

Bar-tacking will prevent fabric tearing at critical points. (It is understood a machine has been ordered).

Cost Factor: Slight; more than compensated for by prevention of damage.

It would be desirable to lighten the weight of the fabric in the RTA combat uniform. However, until a drastic change has been achieved in the staple length and quality of the Thai cotton crop, no change of this kind can be made in the fabric.

DESIGN

No basic change in design is considered to be needed. Two minor changes are recommended, in addition to the drawstring in the trouser bottom buns, included in footwear recommendations.

Recommendation 3

That the sleeve cuffs be provided with gussets and buttons so as to permit a snug closure at the wrist against insects and leeches.

Cost Factor: Some slight additional cost.

Recommendation 4

That the patch pockets on the front of the trousers be eliminated as having little carrying capacity, and easily losing their contents. In their place, cargo pockets should be placed on the sides of the trousers as in U. S. lightweight (Special Forces) trousers.

Cost Factor: No additional cost, compensated for by replacing near-useless pockets by very useful pockets.

HEADGEAR

Recommendation 5

That the present cap be modified to eliminate the flaps and the double layer fabric construction; a single layer of fabric in the top and crown should be sufficient.

Cost Factor: Will result in saving.

Inclosure 1 to
Attachment 1 (Continued)

Recommendation 6

That consideration be given to adopting a brim-type hat similar to that adopted for U. S. Army Special Forces; and that such a hat be tested in the immediate future by Ranger troops.

The new U. S. Special Forces brim-type hat has definite advantages for tropical operations:

- (1) The brim keeps rain and insects from falling down the back of the neck.
- (2) The brim keeps the sun out of the eyes and prevents loss of vision from rain pelting against the eyes or against glasses or goggles.
- (3) The brim supports a mosquito headnet and spaces it away from the face.
- (4) Soft construction permits its being folded up and stuffed into a pocket or the pack.
- (5) Soft brim can be turned up for firing a rifle.
- (6) Chin cord keeps it from being knocked off the head easily; also permits tying up the sides of the hat for firing a rifle.
- (7) Mosquito net also acts as face camouflage.
- (8) By placement of the mosquito net on the top of the hat, it is always available.

CAMOUFLAGE

For Rangers and possibly for other troops, printed camouflage patterns may be desirable on clothing.

Recommendation 7

That consideration be given to providing printed camouflage pattern combat clothing, Ranger and possibly to other troops.

If this recommendation is decided upon favorably, it is suggested that the new pattern developed and tested by the U. S. Corps of Engineers be adopted. This pattern can be printed in Thailand by the local industry. (Design and details can be furnished).

On special combat clothing of this type probably no more than three sizes, i.e. at the most, five sizes, would be needed.

COLD WEATHER CLOTHING

For troops in the northeast of Thailand during winter months supplemental cold weather clothing will be needed.

The development of cold weather clothing for the Thai Army does not, however, appear to be warranted for the limited requirement.

Inclosure 1 to
Attachment 1 (Continued)

Recommendation 8

That a test be made using U. S. Army cold weather clothing by troops stationed in Northeast Thailand during the winter, to determine what supplemental clothing or equipment is actually needed.

The clothing that would be tested would be the following:

Coat, Man's, Field (and liner)
Trousers, Man's, Field (and liner)
Bag, Sleeping, Mountain (and case)
Gloves, Shell, Leather (and liner)

UNDERWEAR

Recommendation 9

That a new pattern be developed for the underwear shorts.

The existing pattern can cause chafing and great discomfort in the crotch.

HANDWEAR

The need for hand protection for troops in typical Thailand areas should be considered from the standpoint of work gloves, protection against thorns and brush when operating in thick tangled areas, and protection against mosquitoes.

OTHER EQUIPMENT

MACHETE or BUSH KNIFE

It is apparent that the needs of the local population have been met by indigenous types of bush knives, developed and made locally. There is considerable ingenuity and a great deal of ingenuity displayed in making these. Many are made from auto springs.

It is not believed that a useful purpose would be served by trying to change this local cultural situation. This is one area where, in our judgment, local ingenuity and development should be encouraged. However, if improved materials are needed to further some particular design, we should provide such assistance.

Recommendation: That an item be selected for standardization so that a carrier can be made for attaching it to the load carrying equipment.

CANTEEN

It is apparent that there is frequently a need to boil water in the canteen, or to pour boiling water into it. Under these conditions it is

ATTACHMENT 4

ADVANCED RESEARCH PROJECTS AGENCY
RESEARCH AND DEVELOPMENT FIELD UNIT
APO 143-BOX 41
SAN FRANCISCO, CALIFORNIA

SUBJECT: Report on Preliminary Evaluation of the Individual Clothing and Equipment of the Viet Nam Military Forces

TO: Director, CDTC-V

Purpose:

The purpose of this study has been to obtain and evaluate information which can be used to design and develop improved clothing and individual equipment for the Viet Nam armed forces.

The short stature and smaller body configuration of Viet Nam troops has clearly indicated that the clothing and individual equipment supplied to them will have to be different from that supplied to U.S. troops. The principal problem that has confronted us has been to determine in what ways it should be different, and how we can adapt U.S. items at no extra cost, or as little added cost as possible, to the needs of Viet Nam troops.

A further factor has been the attempt to set up items so that they can in the immediate future be manufactured in Viet Nam or other nearby areas. This has been less difficult than it would have been a year or two ago, due to the existence today of several modern textile mills, and the very good government clothing factory.

A further, and perhaps the most important aspect in the long run, has been to seek to develop the best items from a functional standpoint. The tropical climate and the physical environment of Viet Nam place severe requirements upon individual combat clothing and equipment. Also, the tropics place severe physiological stress upon man. Accordingly, clothing and equipment for use in such areas should be as light in weight as possible, and should otherwise be so designed and proportioned on the soldier as to minimize physiological stress.

A fifth aspect has been the need to assure that the items will properly fit the men. For example, the boot must have the proper shape and internal space so that it will be comfortable on the foot. Also, it must be issued in the correct size so that it fits properly -- otherwise foot injury will occur. Items must also be used as the designer intended. Hence, provision must be made for the availability of proper instructions on the use of items, and for training in their correct issue and use.

Accordingly, our first approach has been to evaluate the items now in the hands of Viet Nam troops in relation to the above aspects. Many of these items are standard items of U.S. clothing and equipment developed at the

Attachment 4 (Continued)

QM R&E Center. We have also considered what additional items may be needed, based upon U.S. experience in developing equipment for U.S. forces in tropical areas.

This preliminary report represents the initial observations of the use of U.S. clothing and equipment by the Viet Nam Army. It is proposed in this report that several improved items be developed, that certain materials or items be made in Viet Nam on a trial basis, and that evaluation and tests be carried out as soon as possible preparatory to adoption of new or revised items. Following this evaluation and/or testing of certain of those items, a final report is to be prepared in summary of this project.

1 Incl
Comments

S. J. Murphy
S. J. MURPHY
Director, Clothing and Organic Materials
Division
QM R&E Center, Natick, Massachusetts

INCLOSURE 1

TO

ATTACHMENT 4

FOOTWEAR

Boots are perhaps the most important item of equipment furnished to the soldier. For this reason, proper design and construction, proper fitting at the time of issue, proper care and repair, and prompt replacement when necessary, are of great importance.

Recommendation 1

That the condition of boots in the hands of troops be looked into periodically at a command level to determine if the planned rate of replacement is adequate.

Some of the boots being worn by Viet Nam troops examined by our group were in bad condition and should previously been replaced. Also, boots taken from salvage showed excessive wear, beyond the point of safety and health of the wearer. The high ambient temperatures and humidity in Viet Nam, and the repeated wetting and drying of boots which occurs, are very severe on the materials used in footwear. It must be expected, accordingly, that the rate of replacement of footwear here will be among the highest in the world.

Recommendation 2

The cloth boot made in Japan can be made a more satisfactory and serviceable item if the following changes are made in the specification:

1. Increase the height of the boot to nine inches.

In its present height, a good closure cannot be made with the trouser leg to keep out leeches, insects and various kinds of debris. An increased height will make possible tying the trouser leg around the outside of the boot. This is now U.S. policy, and has been proved to be desirable in all climatic areas.

2. Insert drainage eyelets.

These eyelets are needed to let water out of the boot after wading in water over the tops. The eyelets should be screened to prevent entry of leeches.

Inclosure 1 to
Attachment h (Continued)

3. Provide toe-soring.

The flat-lasting of the boot is fatiguing to the muscles of the feet.

4. Replace the present solid anti-spike plate with one that will flex readily over the ball areas (without reducing protection in the instep area).

The present solid plate, combined with the method of manufacture and the soles, creates a sole that is hard to flex and tiring to the muscles of the feet. This present construction is physiologically unsound for a marching boot. Corrective action in this respect is definitely needed. The U.S. type of flexible plate may be found practicable in this boot, but in any event, some change in the construction should be found.

5. Reduce the amount of rubber in the sole of the boot.

This should include a reduction in the height of the heel by $3/16^{\prime\prime}$ to $1/4^{\prime\prime}$. The sole of the boot is over-weight, because of the thickness of the sole and height of the heel. Since failure of the boot appears to occur first in the fabric upper, it is doubtful if there is a justifiable requirement for so heavy a sole.

6. The sole pattern should ultimately be changed to increase the ratio of the area of sole striking the ground to the total sole area.

The boot now picks up too much mud, which increases the weight. A sole pattern could be developed which could have adequate traction, but which would have less space for picking up mud. (This recommendation ties in with the previous one of reducing the amount of rubber in the sole.)

7. The fabric of the upper should be redesigned in another weave to give greater resistance to flexing failure.

A high percentage of boots show failure of the fabric in the 113° area of the vamp. It possibly some of these failures may be due to abrasion, a larger part appears to have started with flex failure. A tight plain weave construction could be expected to be particularly subject to this type of failure.

Recommendation 3

The height of the leather boot being provided to Viet Nam troops should be immediately reduced by two to two and a half inches. Boots in the hands of troops should be altered in local repair shops, or troops should be authorized to have this done by local cobblers. New boots should be altered before or at time of issue.

Inclosure 1 to
Attachment 1. (Continued)

The anthropometric measurements made by Dr. Robert White have shown that Viet Nam troops are approximately six inches shorter than U. S. troops (50th percentile). While his full data are not yet available, he has shown that half of this height difference in Thai troops is below the knees. It is probable that this same height difference will be found to be present on Viet Nam troops, in addition to their overall shorter height.

The U. S. Army has itself recently reduced the height of this same leather boot by $1\frac{1}{2}$ " to $9\frac{1}{2}$ " (middle size). One objective was to reduce interference with the calf muscle. However, if this was applicable for U. S. troops, it is certainly more applicable on the shorter Viet Nam troops.

Also the wearing of the trouser leg inside the boot has been changed to avoid discomfort and to keep foreign matter, water, leeches and insects out of the boot, and now the trouser leg is to be tied around the outside of the boot. Hence, the greater height of the boot is no longer needed at all.

It will probably be some time before the shorter U.S. boot now being procured, reaches the field in all sizes. Pending such time, and to correct an obvious wrong, it is recommended that the above action be authorized at once.

Recommendation 4

The need for the U.S. Army leather boot as a field boot by Viet Nam troops should be reconsidered.

The leather Army boot is actually not suited for the type of climate in Viet Nam, and it will not stand up in prolonged field wear, due to repeated wetting and drying of the leather. While the use of leather preservatives, such as neat's foot oil, can delay such deterioration, it will not prevent it. It is recommended accordingly, that the leather boot be considered prime as a garrison item, and that an improved canvas boot be utilized in most field operations.

Recommendation 5

A new last for footwear for Viet Nam troops should be developed, and all footwear provided to them in the future should be made over this last.

It is apparent from the anthropometric study made by Dr. Robert White that the feet of the peoples of this part of the world differ ethnically to a significant degree from the feet of western peoples. Feet of the same length as those of U.S. troops are significantly wider, and are shaped differently. "Good fitting", as we know it, cannot be achieved on Viet Nam troops with shoes made over U.S. military lasts.

Inclosure 1 to
Attachment 4 (Continued)

It is proposed that a development project under Phase II of this program be set up, and a competent last designer be engaged to develop a suitable last for Viet Nam and Thai troops. It is believed that one last could be made which would serve a large portion of the peoples of this part of the world.

Recommendation 6

That a new and lighter weight and shorter cushion sole sock be provided to Viet Nam troops.

The present cushion sole sock is heavier than needed in this climate. A lighter weight, shorter, and less expensive sock in green color can be made, which can be expected to have greater troop acceptance. It is estimated that such a sock will cost a third less than the present one.

LOAD CARRYING EQUIPMENT

The need for getting suitable load carrying equipment into the hands of the Viet Nam and Thai armies was one of the primary concerns on the part of ARPA in setting up this study. There are three primary problems which confront us in accomplishing this objective:

1. The Size of the Viet Nam (or Thai) Soldier in Relation to the Weight of the Load.

The anthropometric studies conducted by Dr. White have shown that the height of the average Viet Nam soldier (50th percentile) is only 5' ft. 2 $\frac{1}{2}$ inches, as compared with 5 ft. 8 $\frac{1}{2}$ inches for the U.S. soldier; also that he weighs only 108 pounds as compared with 152 $\frac{1}{2}$ pounds for the U.S. soldier.

Using the rule-of-thumb that the soldier's load should not exceed one-third of his body weight, it will be evident that whereas a load of 50 pounds could be adopted for U.S. loads, it should be reduced to not over 35 pounds for Viet Nam soldiers. Hence, if lightening the load of the U.S. soldier, as directed by the Commanding General of CDC, it is even more important for these peoples of Southeast Asia, whom we are assisting in their fight against Communism.

The rule which it would appear should be followed is that every item of personal equipment of the Viet Nam soldier should be one-third lighter in weight than that of the U. S. soldier.

2. The Concept of Combat Operations.

The U. S. load carrying equipment of 1945 and 1956 was in both instances developed around the principle that the soldier would not need to carry with him under most conditions, more than one-half day's supplies. He

Inclosure 1 to
Attachment 4 (Continued)

was to carry 1/3 of a ration. He was also to be able to drop his sleeping equipment in the expectation that it would be brought up to him from the rear along with other supplies. He was to have the capability, however, of carrying his full gear, but it was not expected that he would need to carry more than, at the most, one day's supplies.

The type of operation characteristic of fighting in Viet Nam by all of the Army elements, apparently envisages longer sustained operations without resupply than U.S. load carrying equipment was designed for. The characteristic operation exceeds one full day, and for many operations, a three-day operation without resupply may be expected.

Accordingly, the existing U.S. load carrying equipment either 1945 or 1956, particularly the pack, is too small in carrying capacity to contain the required equipment which the soldier must carry.

Furthermore, the load itself will have to be greater than that planned for U.S. troops, because of the type of operation.

We then have the problem of a smaller man, needing equipment that in total weighs a third less than corresponding U.S. equipment; but who must be prepared to mount an operation in which he may have to carry substantially more supplies than we had planned for U.S. troops to carry.

The need for lightening the weight of everything the Viet Nam soldier carries is therefore doubly important. It is a matter of the greatest urgency, unless the troops are to have their energy needed for fighting needlessly dissipated by the process of carrying their equipment around.

It is recognized that these people are hardy and tough, and are accustomed to great physical exertion. There are physiological limits, however, to the capabilities of all peoples, and it would be wrong to presume that because of this, they should be required to carry needlessly heavy loads.

3. The P. They Now Have.

The U.S. has furnished the Viet Nam Army with surplus stocks of the M-1945 Load Carrying Equipment, including, in particular, the Pack, Field, Combat. At the moment of writing this report, it is not known if further stocks of this pack are still available and are planned for supply to Viet Nam.

The Pack, Field, Combat is definitely unsatisfactory and inadequate for Viet Nam troops:

a. Its carry capacity is too small.

The Pack, Field, Combat is a small pack, and cannot contain what Viet Nam troops need to carry in the type of operations they are carrying out. A suitable pack should be at least a third larger in carrying capacity.

Inclosure 1 to
Attachment 4 (Continued)

b. The attachment of the pack to the suspenders is not good.

Because of this, soldiers using this pack are carrying it on a separate set of shoulder straps, instead of attaching it to the suspenders for the belt. This means that they have two sets of straps coming over their shoulders, one to hold up the ammunition belt, and the other for the pack. Troops on the march have been observed pulling the straps of the pack forward with both hands to keep the straps from cutting into the armpits. This is an intolerable situation.

c. The pack is too heavy.

There are also many old French rucksacks in use. These are preferred to the U.S. pack, apparently for two reasons:

- They have about one-third more carrying capacity.
- The pack is shorter than the U.S. pack, and the load is distributed more across the back.

This French rucksack has some serious shortcomings:

- It has a steel diagonal cross-bar frame that prevents the load from being carried up against the back in comfort.
- It is very heavy - weighs $4\frac{1}{2}$ pounds.
- In addition to the steel bars it has many leather straps.
- It also is suspended over the shoulders by separate straps.

The proper solution to the needs of the Viet Nam Army for load carrying equipment should be met by going to the lightest weight available materials. Every effort should be made to make the carrying equipment as light as possible, to avoid wasting weight here.

best material for the system is nylon. While nylon fiber is not produced in Viet Nam, neither is cotton, to any extent - both must be imported. It is understood that there are weavers of synthetic fiber fabrics in Viet Nam who undoubtedly could make suitable fabrics for this purpose; or some special items like webbings could be supplied, like thread, from the outside.

With nylon the weight of the pack system could be cut in half, bringing it to about 2 pounds, in comparison with the $4\frac{1}{2}$ pounds of the French rucksack.

Inclosure 1 to
Attachment 4 (Continued)

Specifically the pack, or load carrying system, recommended for development for Viet Nam troops, would be one which would be flexible - it could be stripped down to a combat load consisting of:

- the ammunition belt
- suspenders
- entrenching tool
- canteen
- knife or bayonet

Some of these items could also be attached on the back.

To this system, could be added the pack bag, on the style of a conventional rucksack bag. This could be fastened to the harness above the waist in back. It could also be carried separately if desired. This pack bag should have somewhat more capacity than the French rucksack.

Above this pack bag on the back, there would be room to attach the bedding roll, or poncho, or other items of the marching load.

The third component of this system would be a lightweight frame, which could also be attached to the harness, to which the pack bag could be attached. With this frame, a substantially larger load could be carried with comfort. Equipment like a radio, extra ammunition, etc., or extra supplies to sustain a longer operation away from resupply points, could also be carried on this frame.

QM R&E Center personnel are now developing a design of such load carrying equipment based primarily upon materials that could be obtained in Viet Nam. It is planned to utilize textiles that can be made here, so far as possible, and a frame from rattan made by local methods. Prototypes are being developed for evaluation, following which samples will be made for test.

Recommendation 1

If stocks of the M-1945 Pack, Field, Combat are becoming exhausted, no further supplies should be procured for Viet Nam troops.

Recommendation 2

Any additional immediate requirements for packs for Viet Nam troops be met by furnishing the pack bag of the Special Forces' rucksack, with modifications to adapt it to attachment to the M-1945 suspenders. (A sample with these modifications is now being made.)

Recommendation 3

That the prototype load carrying equipment now being developed by QM R&E personnel be evaluated by ARVN Rangers, along with any other packs that may be found to be promising, with a view to adoption of a lighter weight pack with greater carrying capacity by the Ranger Battalions, at the earliest practicable date.

Inclosure 1 to
Attachment 4 (Continued)

Recommendation 4

That the practicability of producing in Viet Nam nylon fabric of the type used in the rucksack bag be explored by personnel of USOM, Industrial Development Division.

SLEEPING GEAR AND RAIN GEAR

The items used for sleeping and for rain protection by the Viet Nam Army at present are:

- The U.S. Army poncho
- The U.S. Army blanket (3-3/4 pounds)
- The U.S. Army shelter half
- The U.S. Army mosquito bar (fabricated in Viet Nam from nylon fabric from the U.S.)
- Mat for sleeping (local)
- Sweater (some troops only appear to have it)

Except for the sleeping mat, all of the above items may be taken into the field. Their combined weight comprises the largest part of the soldier's load, other than his weapon and ammunition. A serious effort should accordingly be made to reduce their weight.

Recommendation 1

The size of the poncho be reduced, and a lighter weight fabric be adopted at the earliest practicable date, to furnish a poncho weighing less than a pound.

The above action will save money as well as weight.

The U.S. Army poncho is definitely too large for these people, who average 6 inches less in height than U.S. troops. A change in size to 82" x 60" should be made immediately, in place of the present 92" x 66". This smaller size will eliminate a "th of the fabric in the poncho.

A lighter weight fabric is urgently needed. The development of such a fabric will be undertaken by QMRC.

Recommendation 2

Issue of the standard U.S. Army 3-3/4 pound blanket should be discontinued as soon as possible, and the Blanket, Lightweight issued in its stead.

The lightweight blanket is now standard for use by U.S. troops in the tropics. It will cut down weight, reduce cost, and at the same time give

Inclosure 1 to
Attachment 4 (Continued)

their troops an item that is entirely adequate for most parts of the country throughout the year. If extra warmth is needed at high altitudes, two light-weight blankets could be supplied.

Furthermore, the blanket lightweight can probably be made in Viet Nam on existing textile equipment. Either fiber or yarn would need to be imported at present, but weaving could be done here.

Recommendation 3

The Shirt, Wool, Knit be made available to Viet Nam troops as a warmth item at night, as all they would need under most field conditions.

This item is lighter and less bulky than the blanket. U. S. experience shows that this a very useful item in the tropic at night.

This item can probably also be made in Viet Nam.

Recommendation 4

That the Net, Multi-purpose, be supplied to Viet Nam troops to serve as a sleeping hammock (with two fifteen-foot lengths of rope), and for other purposes.

Some Viet Nam troops are stated to now carry a hammock made locally. It is not, however, a listed item of supply. The multi-purpose net can probably be made on fish net looms in Viet Nam, and this is now being checked out.

In addition to serving as a hammock, this item can serve many other purposes in a combat situation, such as:

- as an emergency litter,
- to carry bulky or awkward shaped boxes or items, as for example, from a drop zone,
- as an emergency means of carrying loads on pack animals,
- for camouflaging a position, or concealing a cache;
- for covering a panji-pit,
- as a seine for catching fish,
- as a trap for catching animals.

It is believed that other uses will also be found for this multi-purpose net.

It is proposed to have this item evaluated by the Ranger forces in the immediate future. It will be desirable to have this evaluation made available to all concerned as soon as possible.

Inclosure 1 to
Attachment 4 (Continued)

Recommendation 5

That the shelter half, as supplied to Viet Nam forces be modified to eliminate one "V" end-section, in the interest of reducing weight and bulk when it is carried.

The shelter-half for many years had only one end section. However, in anticipation of the invasion of Europe, and possible use of this item in mid-winter, a second end-section was added. It is not needed in this climate, and its elimination will substantially reduce the weight of this item, if it is to be carried into the field.

Authorization should be granted to modify supplies of this item now in the hands of troops.

Recommendation 6

That the insect (mosquito) bar be modified to make a smaller item.

If this item is to be carried into the field at all, it should be made much smaller for Viet Nam troops. Actually a very small net should be all that is supplied. Experimental models are being made and will be furnished for evaluation.

Recommendation 7

That the Australian inflatable pad be evaluated for possible use under some terrain conditions.

CLOTHING

The U.S. Army fatigue jacket and trousers, made of 8.75 ounce sateen do not comprise a satisfactory combat uniform for tropical areas. This outfit is too heavy. When wet, it acts as a thick blanket. It does not encourage evaporative cooling of the skin surface. Although it is very durable, its intended use was for temperate climates, and the wearer pays a high price in discomfort and loss of efficiency when it is worn in the tropics.

The U.S. Army has recently returned to the use in the tropics of the lightweight uniform developed during World War II. This uniform is made from a thin, lightweight (6 ounce), and smooth surfaced fabric, which will encourage evaporative cooling and place less heat stress on the wearer. This uniform is less durable than the utility uniform, but it is U.S. policy that this sacrifice in durability is to be preferred to the greater heat stress of the utility uniform.

Since the U.S. Army is now just getting into production of this lightweight uniform, and it will be some time before the whole Army gets it, it is not recommended that this same uniform be supplied to the Viet Nam Army.

Inclosure 1 to
Attachment 4 (Continued)

at this time. Rather it is considered that a lightweight fabric should be produced in the cotton mills here in Viet Nam, and that their uniform be made from it.

For the present, these mills are producing entirely satisfactory uniform fabrics for other Viet Nam units. It is considered that the fabrics they are now making should immediately start to be used both in their combat and service uniforms.

Recommendation 1

That a locally available fabric, producible in Viet Nam mills, be adopted at once for the uniforms of Viet Nam forces, and that the U.S. cease to supply the 8.2 ounce khaki twill for the service uniform or the 8.7 ounce sateen for the fatigue (utility) uniform.

Samples of fabrics have been shown to us, or a 112 x 57, 9 ounce fabric, made from 36's 2-ply warp and 25's 2-ply filling, twill weave, carded yarn, that would be entirely satisfactory for their uniforms. Actually this fabric is practically identical to our 8.2 ounce khaki twill, except that it is made from carded yarns and runs slightly heavier. With such a fabric available locally, there is absolutely no need to supply such fabrics from the U. S.

It is recognized that this fabric, or others of approximately the same construction, is heavier than should be used ultimately for their combat uniform. The development of a lighter weight fabric, producible on local equipment, and having the necessary strength and serviceability, should, however, be undertaken at the earliest date.

Recommendation 2

That a new lighter weight fabric for their combat uniform, producible in local mills, be developed and evaluated, and if found satisfactory, be adopted for the combat uniform.

The QMRC Center will assist in planning the development of such a fabric.

Recommendation 3

That provision be made for a draw cord or tape in the hem of the trouser legs, by making two button-holes on the inside of the hem to draw the cord through for tying it around the top of the boots.

With the elimination of the requirement for tucking the legs of the trousers into the boot tops, provision should be made for easily tying the trouser legs around the boot tops. A tape or cord can be inserted during manufacture, in which case it should be stitched down so it will not pull out.

Inclosure 1 to
Attachment 4 (Continued)

We bar-tack it on the opposite side. Or the inserting of the cord can be left to the individual soldier. (This recommendation applies only to the combat trousers.)

Recommendation 4

That consideration be given to replacing the patch pockets on the combat trousers with two cargo packets on the sides of the legs.

The present patch pockets are of little value for carrying anything, as they are shallow, and easily lose items. It is suggested that the cargo packets now used on the U.S. lightweight trousers be studied, and that a smaller pocket of this type be placed on the combat trousers of Viet Nam troops. (QMREC will advise on construction or placement if requested.)

Recommendation 5

That the sleeve cuffs be provided with gussets and buttons so as to permit a snug closure at the wrist against insects and leeches.

Recommendation 6

That a brim-type hat be made available generally to all Viet Nam troops.

Where the helmet is not worn, a brim-type hat has distinct advantages over other types of headgear. If possible, the hat should be made from water-resistant material to avoid soaking up water.

Recommendation 7

That a printed camouflage pattern be selected for all troops which represents the best principles of camouflage design.

It is noted that several patterns have been used by Viet Nam forces on their uniforms. Some are of doubtful value, in the light of extensive studies of camouflage of the individual soldier made by the U.S. Army Corps of Engineers and the R&E Center. It would be desirable to have proposed patterns checked by the Corps of Engineers before adoption.

Recommendation 8

That any needs for hand protection be clarified, so that determination of what kinds of handwear are needed, can be made, e.g., protection against thorns and brush when operating in thick tangled areas, etc.

Inclosure 1 to
Attachment 4 (Continued)

Recommendation 9

That the present V.I. Army cap be discarded at the earliest practicable date, and that, if a cap is desired, one of simpler construction and lighter in weight be developed, tested and adopted. Specifically, it is suggested that the style of the U.S. baseball cap be considered.

The present cap is modeled in design on the former U.S. Cap, Field. It is constructed with sidewall stiffening of heavy burlap. The cap is unnecessarily heavy, will absorb a lot of water, and is a poor design for the tropics. Furthermore, it costs more than a better cap would cost. This matter should be looked into as a matter of urgency, regardless of what action is taken on the adoption of a brimmed hat, either for special operations or for general wear.

Recommendation 10

That a reversible uniform made from a lightweight fabric, black on one side and with a camouflage pattern on the other, be evaluated for adoption for special type operations, or for general field use as may be determined to be desirable.

BODY ARMOR

Recommendation 1

That, in the interests of saving weight where it is most needed, the present helmet and liner be replaced at the earliest practicable date with the new ballistic helmet liner, on a priority basis.

That the new ballistic helmet liner has only slightly less protection against fragmentation weapons than the present helmet. By eliminating the helmet entirely, a saving of almost three pounds could be made in the weight carried by the soldier, without significant loss in protection. Since the helmet does not protect against small arms fire anyway, the men would lose nothing in that respect.

Recommendation 2

That, although body armor vests are not being used and are not required in the present type of warfare, in the event the use of fragmentation weapons should increase significantly, a new extra small size vest be designed against the anthropometric measurements of Viet Nam troops, so that it could be furnished quickly if needed.

Recommendation 3

That the new protective shield against small arms fire, for helicopter pilots, be thoroughly evaluated, and any needed changes in design

Inclosure 1 to
Attachment 1 (Continued)

or shape be made to accommodate pilots or crews.

This new shield utilizes the only material now available for stopping AP small arms fire. It is so designed that the weight is carried by the seat and the harness, and it does provide positive protection against AP 30 cal. fired at a distance of five feet with zero obliquity.

OTHER EQUIPMENT

MACHETE

It is apparent that the U. S. Machete is definitely too long for these peoples; also it is a style that does not correspond to their indigenous bush knife.

Recommendation 1

It is recommended that the U. S. Machete not be provided to ARVN, nor be modified for their use.

The indigenous types of bush knives, fabricated locally, seem to be well-liked and accepted by ARVN troops.

Recommendation 2

That no useful purpose would be served by the U.S. trying to select a machete for ARVN, but that they be encouraged to standardize on a type of knife, in order that a carrier can be developed by which it can be attached to the load carrying system.

Also, if assistance is required with respect to the hardness or grade of steel, QMAG will provide such technical assistance as is needed.

FREE-FALL WATER DELIVERY CONTAINER

Recommendation:

That a free fall water delivery container be developed for use in supplying drinking water away from their base of supply.

The need is for a five or ten gallon plastic container which can be dropped on signal through the jungle canopy to troops in action. The "flying saucer" is not acceptable as it would give the enemy a material, which if recovered by them, could be used to make sandals.

Reference has been made to an item used in World War II, and also to a double bottom plastic bag used for this purpose by the British in Malaya. Anything that might hang up the bag in the trees would be unacceptable.

November 1 1963

Estimated Required Funds to Complete Project
India - Civil Clothing and Equipment for
All American Forces in Southeast Asia

<u>THAILAND</u>	<u>General</u>	<u>Technical</u>	<u>Funds Required</u>	<u>Estimated Completion</u>	<u>Notes</u>
	<u>Agency</u>	<u>Agency</u>	<u>FY 64</u>	<u>FY 65</u>	
	Footwear				
	Rec. 1 - Reduce Weight of Boot.	X			30 Pairs of Boots of Reduced Weight being Evaluated.
	Rec. 2 - Draw Cord in Bottom of Trouser	X			20 Trousers Being Evaluated.
	Rec. 3 - Proper Fitting of Shoe	X			
	Rec. 4 - Socks	X	\$300	FY 64	For Test Item.
	Rec. 5 - Lug Sole	X		FY 65	For Improvement of Sole and Sole.
	Rec. 6 - Synthetic Thread	X	\$200	FY 65	Comparison of Thread Underway.
	Rec. 7 - Mildew Proofing of Leather	X			
	Rec. 8 - Brass Drainage Fittings	X	\$100	FY 64	
	Rec. 9 - Spike Resolution	X	\$5,000	FY 65	For Test Items and Development.

THAILAND (Continued)

	<u>Contract</u> <u>Technical Assistance</u>	<u>Funds Requested</u> <u>FY 65</u>	<u>Estimate of Completion</u>	<u>Notes</u>
Rec. 10 - Cloth Upparv		\$500	FY 65	For Fabric.
Rec. 11 - How Laut (Sou Viat Han)				
<u>Load Carrying Equipment Development of Transport Pack</u>		\$20,000	FY 65	For Completion of Development.
<u>Sleeping Gear and Rain Gear</u> Two, [] - Development of Lighter Weight Poncho		\$2,000		Possibly same as Viet Nam, but possibly will have to be different w/c local resources.
Rec. 3 - Lighter Weight Blanket	X	\$1,000		For Sample.
Rec. 4 - Multi-purpose Net		\$5,000		To try to make from Local Resources or Facilities.
Rec. 5 - Light weight Sweater	X			
<u>Clothing</u>				
Rec. 1 - Button Fabric	X			They Will Make in Their Mills.

THAILAND (Continued)

<u>General Technical Requirement</u>	<u>Funding Required FY 64</u>	<u>Estimated Completion</u>	<u>Notes</u>
Roc. 2,3,4 - Design Chinotou	\$		
Roc. 1 - Cap Hatch	X		
Roc. 6 - Brain Type Nut		FY 64	
<u>Canouf' Lalo</u>			
Roc. 7 - Printed Canouf' Lalo	\$3,000	FY 64	
Roc. 8 - Cold Weather Clothing	X		
Roc. 9 - Undervar Shortn	X		
	\$500	FY 64	To Make Patterns and Prototypes.
<u>Macholo Carrier</u>	\$1,000	FY 64	For Sheath for Macholo Developed by Thailand CIVTC.
<u>Gantzen</u>	\$500	FY 64	For Test Items.
<u>Ditrenching Tool</u>	\$1,000	FY 64	For Indivdual carrier (development and procurement of test item).

THAILAND (Cont'd)

<u>General</u>	<u>Funds Required</u>	<u>Estimated Completion</u>	<u>Notes</u>
<u>Technical</u>	<u>FY 70</u>	<u>FY 65</u>	
<u>Auxiliary</u>	<u>FY 70</u>		
<u>Mosquito Bar</u>			FY 65 Same as for Viet Nam.

Direct Charges
Overhead 56%
Travel, Supplies and Other

\$10,107
22,156
\$32,556
5,000
\$37,556

November 1963

Estimated Required Funds to Complete Project

VIET NAM Clothing and Equipment for

Intelligence Forces in Southeast Asia

<u>General Technical Assistance</u>	<u>FY 64 Funds Required</u>	<u>FY 65 Funds Required</u>	<u>Estimated Completion</u>	<u>Note</u>
Proj. 4 - Improvement of the Japanese Jungle Boot				
a. Development in Japan				
b. Development in the U.S. (excluding the last)	\$20,000	FY 65	Including purchase of two lots of 200 pairs each. Contract to be placed by Sep 64.	
Proj. 5 - Development of a New Lamp	\$33,500	FY 65	Develop Master Model-\$10,000 Fabricate Models -\$14,500 @150 ea 2 on 30 sizes	
			Fabricate Turning -\$15,000 Models 300 assorted sizes @ \$50	
			Develop Basic Pattern-\$4,000 \$23,500	
Proj. 6 - Develop lighter Weight Cushion Sole Sock	\$2,500	FY 64		

VIE. MAH (Continued)

<u>General Technical Assistance</u>	<u>Funds Required FY/64</u>	<u>Estimated Completion FY765</u>	<u>Notes</u>
<u>Loud Carrying Equipment Rec. 3 - Develop Tenter Pack</u>	\$15,000	FY 65	Included materials, drawings and prototypes for 250 packs
Rec. 4 - Exploring developing the fabric in Viet Nam	X		
<u>Sleeping Gear and Rain Gear Rec. 1 - Develop a poncho Weighing One Pound</u>	\$25,000	FY 65	Included 700 for Viet Nam 300 for Thailand Development of fabric and poncho, including spec.
Rec. 2 - Issue the light weight blanket	\$1,000	100 for test	
Rec. 3 - Shirt, Wool, Knit	\$1,000	100 for test	
Rec. 4 - Not., Multipurpose X		600 already shipped for test (\$20,24)	
Rec. 6 - Make a Smaller Mosquito Bar	\$5,000	FY 65	
Rec. 7 - Australian Inflatable Sleeping Pad	X		60 already procured for test (700)

Vietnam (Continued)

	<u>General</u>	<u>Technical</u>	<u>Funds Required</u>	<u>Estimated Completion</u>	<u>Notes</u>
	<u>Aus. stance</u>		<u>FY 64</u>	<u>FY 65</u>	
<u>Clothing</u>					
Rec. 1 " Mako & Fabric Locally to Replace Current Saloon	X				
Rec. 2 " Make a Lighter Weight Fabric for Tropical Uniform	X				
Rec. 3,4,5 - Design Changou Ar. ARVN Uniform	X				
Rec. 6,9 - Headgear	X				
Rec. 7 - Camouflage Patterns	X				
Rec. 8 - Gloves	X		\$2,000	FY 64	3,000 yards already shipped.
Rec. 10 " Reversible Uniform					150 pair going (\$600)
<u>Body Armor</u>					
Rec. 1 - Use Helmet Liner	X				To modify patterns and make prototypes. (Expected required modifications).
Rec. 2 - Mako an Extra Small Size Vest			\$4,000	FY 64	To make patterns and prototypes.

VIEET NAM (Continued)

<u>General Technical Area</u>	<u>Funds Required FY 64</u>	<u>Funds Required FY 65</u>	<u>Estimated Completion</u>	<u>Notes</u>
<u>Fac. 3 - Protective Shield for Pilots</u>			FY 65	No work programmed beyond correction of current model.
<u>Machto Make a Carrier</u>	\$11,000		FY 64	
<u>Prog Full Water Container</u>	\$10,000		FY 65	
<u>Dir. "C" Univ Overhead, etc.</u>	\$100,000 \$6,000		\$20,000 11,200	
<u>Trans. Supplies & Other</u>	\$156,000 30,000 \$186,000		\$31,700 20,000 \$1,200	